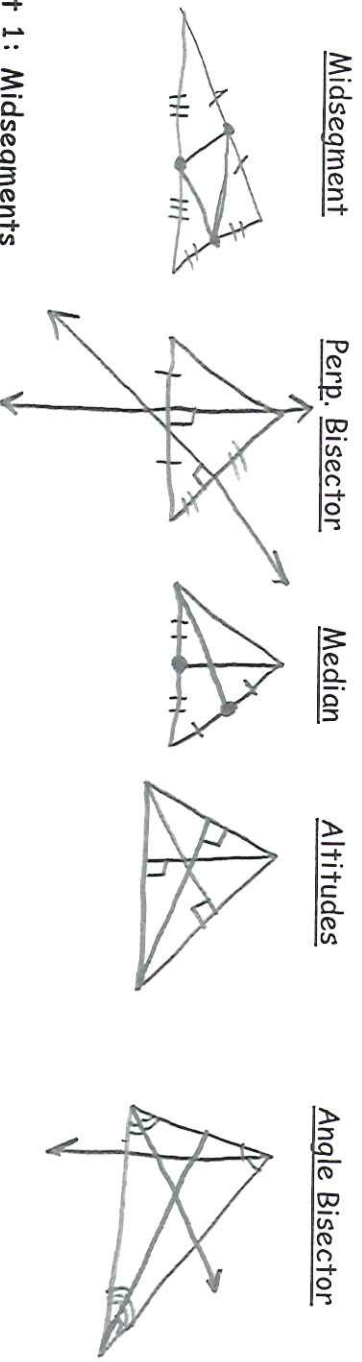


Today you will be studying some pretty cool things that happen within triangles. Below, put the drawings all the vocabulary words we put on the board.



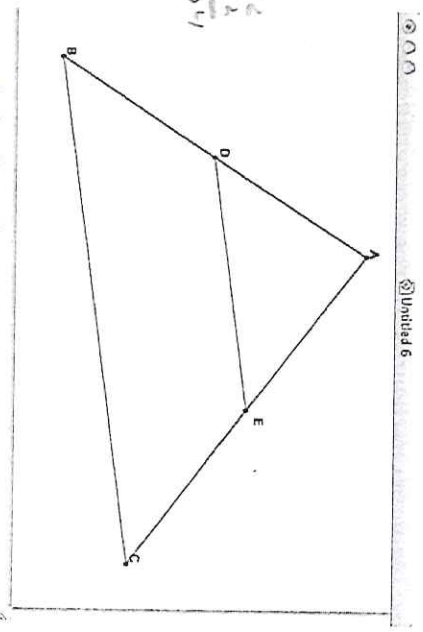
Part 1: Midsegments

The first object we are going to study are the midsegments of triangles. Follow the following steps on your sketchpad to discover the Triangle - Midsegment Theorem.

1. Construct a triangle ABC.
2. Construct the midpoint of AB and label it D.
3. Construct the midpoint of AC and label it E.
4. Connect the midpoints with the *midsegment*. Your drawing should look like the one at the left.

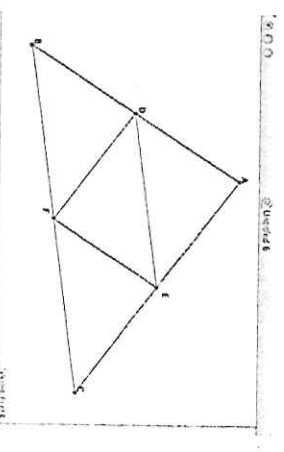
5. Measure the length of DE. $\frac{2.52 \text{ cm}}$
6. Measure the length of BC. $\frac{5.05 \text{ cm}}$
7. Calculate the slope of DE. $\frac{0.03}{1}$
8. Calculate the slope of BC. $\frac{0.03}{1}$

Move the triangle around and observe how both the slope and the lengths change.



Make a conjecture about the relationship between the lengths and slopes of the midsegment and the side opposite it. The slope of the midsegment and the side opposite it are \approx . The length of the midsegment is about half of the side opposite it.

9. Construct the midpoint of BC and label it F.
10. Construct the other two midsegments of triangle ABC.
11. Measure the lengths of the midsegments and the sides opposite to them. Also calculate the slopes of each of them. Determine if your conjecture was correct. Place your measurements below.



$$\frac{2.47}{11.96}$$

- AB: $\frac{4.83 \text{ cm}}$ Slope AB: $\frac{1.89}{1}$
- EF: $\frac{2.41 \text{ cm}}$ Slope EF: $\frac{1.89}{1}$
- AC: $\frac{4.95}{1}$ Slope AC: $\frac{1.47}{1}$
- DF: $\frac{2.48}{1}$ Slope DF: $\frac{1.47}{1}$

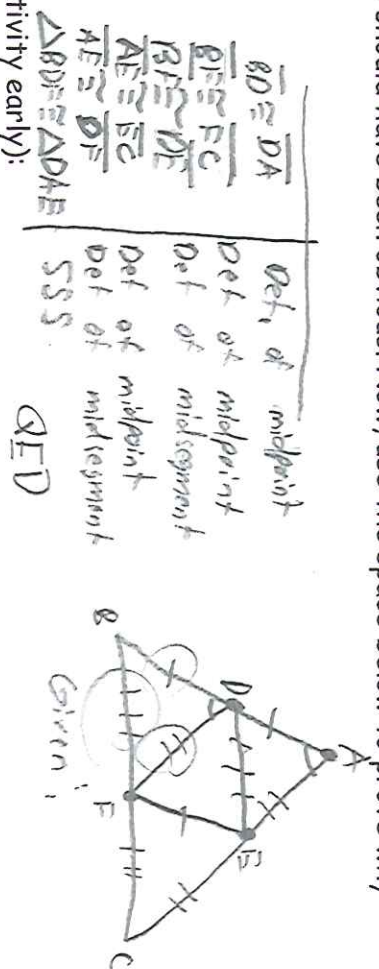
Do you believe your conjecture was correct? Explain.

Yes because the slopes of the midsegment and side opposite it were \approx and the side length was just about double the midsegment's length.

12. You should now see for smaller triangles within a larger one. Calculate the areas of each of the small triangles.

$$6.31 \text{ cm}^2 \text{ for all}$$

13. The relationship between areas should have been obvious. Now, use the space below to prove why that is the case.



Extension (only if you complete the activity early):

- Construct a quadrilateral RSTU.
- Construct the midpoints of each side of the quadrilateral.
- Join the midpoints to form quadrilateral YXWZ.
- Measure the sides and slopes of each of the midsegments and sides.
- Make a conjecture relating the sides of a quadrilateral to its midsegments.

Part 2:

The next part will be to study the quite interesting relationships between the perpendicular bisectors, angle bisectors, and medians of triangles.

- Open 4 separate windows of Sketchpad.
- In one of your windows construct a triangle and then construct the perpendicular bisector of each side. Somewhere in your window make a text box that reminds you that these are perpendicular bisectors
- Open another window. Construct a triangle and then create the three angle bisectors of this triangle. Make a text box that labels this window "Angle Bisectors."
- In the third window construct the lines that contain altitudes of a triangle. You will do this by creating perpendicular line through each vertex.
- In the fourth window construct the lines that contain the medians of a triangle. You will do this by creating the midpoint of each side and then connecting the midpoint with the opposite vertex.

In each of the windows above, describe what is happening with the perpendicular bisectors, angle bisectors, altitudes, and medians? I've noticed they all divide

the triangle into 6 triangles

Move the triangles around in each window. Does your observation hold true? NO

Write a conjecture about the perpendicular bisectors, angle bisectors, the lines containing the altitudes, and lines containing the medians of a triangle. They all create 6

congruent triangles

For each of the four windows you have open, you are going to manipulate your triangles to create acute, obtuse, and right triangles. In each box, write the location of intersection point of the lines. Your answers will either be *inside of*, *outside of*, or *on*. *On* means the lines intersect on a side of the triangle.

	Perpendicular bisectors	Angle bisectors	Lines containing altitudes	Medians
Acute	Inside of	Inside of	Inside of	Inside of
Obtuse	Outside of	Inside of	Outside of	Inside of
Right	On	Inside of	On	Inside of

Your table above is describing where each set of lines intersect. However, one of these points is always equidistant from the three vertices of the triangle, no matter the shape. What special segment have this property? Perp. bisector

Extension: Isosceles and Equilateral Triangles

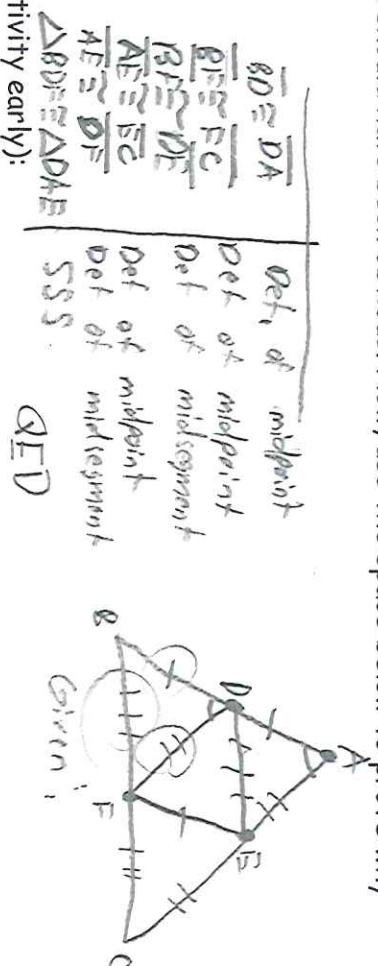
1. Create isosceles and equilateral triangles.
2. Create the four vocabulary words for each triangle.

What do you notice about the intersection point for each of the triangles? _____

12. You should now see for smaller triangles within a larger one. Calculate the areas of each of the small triangles.

$$6.51 \text{ cm}^2 \text{ for all}$$

13. The relationship between areas should have been obvious. Now, use the space below to prove why that is the case.



Extension (only if you complete the activity early):

- Construct a quadrilateral RSTU.
- Construct the midpoints of each side of the quadrilateral.
- Join the midpoints to form quadrilateral YXWZ.
- Measure the sides and slopes of each of the midsegments and sides.
- Make a conjecture relating the sides of a quadrilateral to its midsegments.

Part 2:

The next part will be to study the quite interesting relationships between the perpendicular bisectors, angle bisectors, and medians of triangles.

- Open 4 separate windows of Sketchpad.
- In one of your windows construct a triangle and then construct the perpendicular bisector of each side. Somewhere in your window make a text box that reminds you that these are perpendicular bisectors
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- In the third window construct the lines that contain altitudes of a triangle. You will do this by creating perpendicular line through each vertex.
- In the fourth window construct the lines that contain the medians of a triangle. You will do this by creating the midpoint of each side and then connecting the midpoint with the opposite vertex.

In each of the windows above, describe what is happening with the perpendicular bisectors, angle bisectors, altitudes, and medians? I've noticed they all divide the triangle into 6 triangles

Move the triangles around in each window. Does your observation hold true? NO

Write a conjecture about the perpendicular bisectors, angle bisectors, the lines containing the altitudes, and lines containing the medians of a triangle. They all create 6

congruent triangles

For each of the four windows you have open, you are going to manipulate your triangles to create acute, obtuse, and right triangles. In each box, write the location of intersection point of the lines. Your answers will either be *inside of*, *outside of*, or *on*. *On* means the lines intersect on a side of the triangle.

	Perpendicular bisectors	Angle bisectors	Lines containing altitudes	Medians
Acute	Inside of	Inside of	Inside of	Inside of
Obtuse	Outside of	Inside of	Outside of	Inside of
Right	On	Inside of	On	Inside of

Your table above is describing where each set of lines intersect. However, one of these points is always equidistant from the three vertices of the triangle, no matter the shape. What special segment have this property? Perp bisector

Extension: Isosceles and Equilateral Triangles

1. Create isosceles and equilateral triangles.
2. Create the four vocabulary words for each triangle.

What do you notice about the intersection point for each of the triangles? _____
